Eric C. Smith

HAND-OPERABLE PISTON PLUNGER

Background of the Invention

1. Field of the Invention.

The present invention relates to a power plunger for dislodging clogs in plumbing drains and, more particularly, to a plunger having a hand-actuatable piston means and an enclosed volume which together facilitate the intake and subsequent injection of clog liquid/fluid to thereby impact and dislodge a plumbing clog.

2. Related Art.

Plungers are commonly used for unclogging blocked drains. The basic plunger consists of a rubber suction device mounted on a handle. This basic plunger, while effective for many clogs, has its associated problems. These problems include limited suction power to dislodge clogs and a tendency to displace a high volume of water/fluid, both when first inserted and then during actual plunging action. As a result, splashing and/or overflow of drain liquid/fluid may result. In an attempt to at least increase the available suction power for a plunger, an accordion/bellow section has been added to many versions to increase the change in volume and thereby the amount of pressure which may be generated with the plunger.

There are many circumstances in which the common plunger cannot dislodge the clog within a drain. As a result, there are a series of power plungers which have been developed. Such power plungers generally use a pressurized fluid source or water flow via a pump mechanism to create a positive fluid pressure against the clog. Such power plungers have generally proven to be more effective against tough clogs. However, an

obvious potential drawback of such a power plunger is that the addition of more fluid to an already clogged drain may alone cause overflow. Additionally, such power plungers are generally complex in nature and usually require a hookup with another fluid or water source.

What is needed in the art is a hand-operable plunger which is self contained, simple to use, and which is able to create a positive pressurized fluid flow against a clog to thereby increase its effectiveness in dislodging clogs.

Summary of the Invention

The hand-actuated piston plunger of the present invention is configured to use clog fluid already present in a plumbing unit having a backed-up drain to thereby create a pressurized injection fluid stream to be directed at a clog.

The hand-actuated piston plunger of the present invention includes a vessel member, a drain adapter, a plunger piston, and a piston actuator. Such a plunger may further advantageously be equipped with an actuator handle, a vessel handle, and/or a bellow/accordion arrangement within the vessel member. The vessel member has first and second vessel ends and a hollow vessel interior. The drain adaptor is associated with the first vessel end and includes an adaptor opening which facilitates selective flow of fluid relative to the vessel interior. The piston plunger is slidably mounted within the vessel interior and is movable relative to the drain adaptor. The piston actuator has a first and second end with the first end operably associated with the plunger piston. The second end of the piston actuator extends outside of the vessel interior. This piston actuator can then be used to move the plunger piston within the vessel interior in such a manner so as to selectably either draw clog fluid into the vessel interior or to expel it

therefrom. The provision of actuator and/or vessel handles allow for greater control during use of the plunger of the present invention. A bellows/accordion arrangement positioned within the vessel interior and interconnecting the first vessel end and the plunger piston provides for a changeable yet sealed working volume for the clog fluid.

One of the advantages of the present invention is that the initial suctioning of clog fluid prior to fully inserting the piston plunger into the clogged area reduces the opportunity for initial overflow due to clog fluid displacement.

Another advantage of the present invention is that the use of clog fluid as the fluid source for clog impact generally eliminates the need for an additional fluid supply, unlike the power fluid flow plungers of the prior art.

An additional advantage of the present invention is that the plunger is simple and quick to operate, requiring no auxiliary water/fluid supply for hookup and no valves to operate.

A yet additional advantage of the present invention is that no change in adapters is needed to go from a sink to a toilet, or vise versa.

A further advantage of the present invention is that it is totally self contained and independently operable.

A yet further advantage of the present invention is that it lends itself to easy cleaning. It can be quickly cleaned by operating of the piston pump within clean water, thereby flushing the interior therewith. It is further contemplated that household cleaners and/or disinfectants can be added to the water used for flushing for added cleaning/disinfection.

An even further advantage of the present invention is that the plunger can be made so as to permit quick and selective disassembly of the various parts to thereby allow for even further cleaning and/or for needed part replacement.

Brief Description of the Drawings

The above-mentioned and other features and advantages of this invention, and the manner of attaining them, will become more apparent and the invention will be better understood by reference to the following description of various embodiments of the invention taken in conjunction with the accompanying drawings, wherein:

Figs. 1-3 are schematic sectional views of a first embodiment of the piston plunger of the present invention, illustrating three stages of operation thereof;

Fig. 4 is a schematic sectional view of the vessel member of the piston plunger of the present invention carrying a piston therewithin and having a first embodiment of a vessel handle affixed thereto;

Fig. 5 is a schematic, partial sectional view of a vessel member of the piston plunger of the present invention with the vessel member having a piston positioned therewithin and having a second embodiment of the vessel handle attached thereto;

Fig. 6-8 are schematic sectional views of a second embodiment of the piston plunger of the present invention, illustrating three stages of operation thereof; and

Fig. 9-10 are schematic sectional views of an embodiment of the piston plunger of the present invention which incorporates a bellows/accordion structure therewithin, illustrating the two primary stages of operation thereof.

Corresponding reference characters indicate corresponding parts throughout the several views. The exemplifications set out herein illustrate at least one preferred

embodiment of the invention, in one form, and such exemplifications are not to be construed as limiting the scope of the invention in any manner.

Detailed Description of the Invention

Hand-operable piston plunger 20, illustrated in various stages of operation in Figs. 1-3, represents a first embodiment of the plunger of the present invention. Hand-operable piston plunger 20 is configured for freeing a clog 22 within the piping/drain 24 associated with a particular plumbing unit 26 (e.g., a toilet or sink) using clog/back-up fluid 28 already collected within plumbing unit 26. Hand-operable piston plunger 20 includes a vessel member 30, a plunger piston 32, a piston actuator 34, a vessel handle 38, and an actuator handle 40.

Vessel member 30 has a vessel interior 42, and through operation of the combination of the plunger piston and piston actuator, it is configured for selectively receiving clog/back-up fluid therewithin. The vessel interior 42 must be large enough to hold a suitable amount of fluid (as best seen in Fig. 2) for the plunging of difficult clogs 22. The vessel member 30 is advantageously made of a plastic material as such materials generally are relatively inexpensive, chemically and mechanically durable, and generally easy to clean. Alternatively, vessel member 30 could be made of a durable, corrosion/rust resistant metal or other material. It is very useful for a vessel member 30 to be made of rust and corrosion resistant material so as to thereby retain, long-term, a smooth surface on the vessel interior 42 to allow for easy piston movement therewithin.

Vessel member 30 further includes a first vessel end 44 and a second vessel end 46. Associated with first vessel end 44 is a first end stop 48, while second vessel end 46 has a second end stop 50 associated therewith. First end stop 48 and second end stop 50

together provide the travel limits for piston 32 within vessel interior 42. First end stop 48 must be supplied with at least one first stop opening 52 to allow fluid communication between drain adapter 36 and vessel member 30. In this first embodiment, the first end stop 48 is integrally attached to drain adaptor 36 and as such may further be one of integrally or separably attached to first vessel end 44. It is to be understood that first end stop 48 could take the form of a ledge, a pin, a set of pins, or some sort of spider web arrangement connected to first vessel end 44 to provide for the necessary stop feature for end stop 48. As such, first end stop 48 need not necessarily be a part of drain adapter 36.

Second end stop 50, as shown, is in the form of an end cap which is mechanically releasably attached to second vessel end 46. It is to be understood that other possible configurations for second end stop 50 may be chosen, although not shown as part of this particular embodiment. Specifically, vessel member 30 can be an essentially open container without a lid as long as the function of the second end stop 50 is provided for (i.e., plunger piston 32 is not able to escape from second vessel end 46 during upward operation of piston plunger 20.).

At minimum this limit stop requirement for second end stop 50 could be provided for simply by the presence of an inwardly extending ledge or pin(s) (not shown) at second vessel end 46. However, it is advantageous that second end stop 50 also be able to provide lateral support for piston actuator (plunger shaft) 34 during operation thereof. One means of providing for this feature is for second end stop 50 to have a "spider" arrangement which leaves an appropriate size opening for receiving the plunger shaft/piston actuator therewithin. It is to be understood that the cap version for second

end stop 50, as shown in Figs. 1-3, satisfies this desired support/stability function for second end stop 50.

The plunger piston 32 of the first embodiment, as shown in Figs. 1-3, is slidably mounted against vessel interior 42. It is important in such an embodiment for plunger piston 32 to retain a seal against vessel interior 42 as well as maintaining a seal therewith during operation. This is such that unwanted leaking of the clog fluid 28 to regions above plunger piston 32 can be avoided, and so that the pressure associated with the operation of piston 32 can be most effectively maintained. It is useful that plunger piston 32 be made of a plastic or polytetrafluoroethalene (PTFE, sold under the trade name Teflon™) or potentially of a corrosion resistant metal.

The material chosen must be able to allow for easy motion of the piston 32 yet maintain an appropriate seal with vessel interior 42. Additionally, such a material must be rust and corrosion resistant since active drying of the vessel interior after use thereof is not always feasible. As such, the vessel interior 42 and plunger piston 32 can be expected to be subjected to exposure to moisture for generally long periods of time after use of the plunger 20. Additionally, the plunger piston 32 should be chemically resistant to most household cleaners, drain opening solutions, and/or disinfectants to which plunger 20 may be exposed, either during use or cleaning thereof.

To provide for a better seal between plunger piston 32 and vessel interior 42, an additional seal member such as an o-ring seal (Fig. 4) may be supplied. Such a seal would better ensure the integrity of the seal between piston 32 and vessel member 30. This is especially true if a metal piston 32 is being employed, since the coefficient of

friction associated with a metal piston can be expected to decrease with the formation of any sort of corrosion or any mechanical wear on the surface thereof.

Plunger piston 32, along with vessel interior 42 and first vessel end 44, define a variable fluid volume V within vessel member 30. This volume V will of course be dependent upon the positioning of piston 32. The expansion of volume V via movement of plunger piston 32 toward the second vessel end 46, will draw fluid into the vessel interior 42 via drain adaptor 36. Conversely, the movement of plunger piston 32 toward first vessel end 44 will serve to contract volume V and expel fluid from piston plunger 20. The faster plunger piston 32 is moved, the more force with which fluid (e.g., air, liquid, suspension, etc.) is able to be drawn or expelled.

By having plunger piston 32 positioned adjacent first vessel end 44 prior to insertion of piston plunger 20 into plumbing unit 26 and into clog fluid 28, clog fluid 28 can then be drawn into the vessel interior 42 upon insertion of drain adaptor 36 into clog fluid 28. The volume V of clog fluid 28 within vessel interior 42 can be then increased to its maximum by movement of plunger piston 32 towards second vessel end 46, thereby providing the fluid for use by the piston plunger 20 to free the clog and creating volume space for the insertion of piston plunger 20 into position proximate the piping/drain 24.

Once drain adaptor 36 is appropriately positioned relative to drain 24, piston actuator 34 is pressed forcefully downward. This downward motion causes plunger piston 32 to rapidly expel the clog fluid 28 out of the vessel interior 42 and through drain adaptor 36 and into drain 24. This expelled fluid 28 acts upon the clog 22 and, when successful, provides enough force to cause the clog to free from the piping/drain 24 and thereby allow the entirety of clog fluid 28 to proceed down through drain 24.

Drain adaptor 36 is releasably attached or molded to first vessel end 44. Drain adaptor 36 is configured such that it creates a fluid connection of the vessel interior 42 with the exterior of the piston plunger 20 and allows for a fluid connection to be made with the drain fluid in the plumbing unit 26 and/or drain 24. Drain adaptor 36 is advantageously removably attached for periodic, more vigorous cleaning and to permit replacement thereof is necessary due to air.

There are certain advantages gained by having drain adaptor 36 having a conical or frusto-conical shape. First of all, such a conical shape allows drain adaptor 36 to fit into various diameter drains 24. Thus, it eliminates the need to change adaptors 36 to accommodate different drain sizes. Additionally, the conical shape helps create a venturi nozzle effect during expulsion of clog fluid 28 through the drain adaptor 36, thereby increasing the effective ejection speed which may be achieved.

Drain adaptor 36 is preferably made of rubber or another elastomeric material. By being made of such a material, it aids in the insertion of drain adaptor 36 into a given drain opening. The highly elastic nature of such a material helps to accommodate the forces applied to the adaptor 36 due to the suction and ejection processes. Finally, elastomeric materials are generally reasonably inert and thereby can withstand exposure to a variety of household chemicals, including drain opener chemicals, which may have been added to the clog fluid 28.

Piston actuator 34 connects to plunger piston 32 within vessel interior 42 and extends through second vessel end 46 so as to provide a portion thereof available for actuation by hand. Such a piston actuator 34 is an elongate member that can be made of any of a variety of materials including wood, metal, or plastic. The variety of materials

available for use of the piston actuator are more varied than those available for the other portions as the exposure of the piston actuator to clog fluid 28, including any drain cleaner added thereto, is limited since it is placed on the dry side of piston 32. It is important that the material chosen for piston actuator 34 be mechanically durable and strong to obtain an appropriate transfer of mechanical power to piston 32 for effective plunging.

Piston actuator 34 has some significant functional differences when compared to the prior art handle associated with a standard plunger. The standard prior art plunger is affixed on top of a suction member and is arranged so that the first plunging step, once the suction device is entered into the water, is to move the drain-adapting suction device downwardly toward and into contact with drain 24. This first step is different from that for the piston actuator of the 34 of the present invention. Specifically, actuator 34 is intended first to be moved upwardly away from first vessel end 44 in order to draw water into the vessel interior 42. It is not until an appropriate amount of fluid 28 has been drawn into vessel interior 42 that the piston actuator 34 is then forced downwardly toward first vessel end 44 to cause fluid expulsion via the use of plunger piston 32. Additionally in the present invention, the function of piston actuator 34 is solely to move piston 32 relative to vessel interior 42. It is not the function of piston actuator 34 to move drain adaptor 36 into its appropriate location. Instead, drain adaptor 36 is moved using vessel handle 38.

Figs. 4 and 5 help to illustrate two different embodiments for the vessel handle, the first embodiment vessel handle 38, as shown with the embodiment shown in Figs. 1-3, and the second embodiment vessel handle 56, as illustrated in Fig. 5. Vessel handle 56,

shown in Fig. 5, is configured to allow more vertical pressure to be applied to the seal contact area between drain 24 and drain adaptor 36. The longer version for the first-embodied handle, vessel handle 38, may prove useful in allowing any of a range gripping positions relative to the length of vessel member 30 to be grabbed by a user, potentially allowing for greater control of the placement of drain adaptor 38 relative to a particular drain 24. This extra length can especially prove useful when using the piston plunger 20 relative to a sink where the clog fluid 28 may not raise such a concern with respect to potential contact therewith. In any event, it is this handle 38, 56 which is used to appropriately locate drain adaptor 36 relative to a drain 24 and to create a sufficient seal between adaptor 36 and that drain 24 to promote an effective plunging operation.

A second embodiment of the piston plunger is illustrated in Figs. 6-8 in the form of piston plunger 60. Only those portions thereof which differ from the parts presented with respect to piston plunger 20 are labeled differently than the corresponding parts associated with piston plunger 20. Further, it is only those differing parts which are described in detail with respect to piston plunger 60. Additionally, the general method of operation of plunger 60, as indicated in Figs. 6-8, is essentially the same as that presented for the first embodiment in Figs. 1-3.

The two primary structural differences related with respect to piston plunger 60 are drain adaptor 62 and actuator handle 64. Drain adaptor 62 is bell shaped in nature and generally provides a wider opening for a positioning proximate drain 24. As such, it is possible for a larger amount of fluid to be taken in or expelled via adaptor 62 at any given time. Additionally, the bell shaped nature of the adaptor 62 provides for a more

significant amount of sealing area adjacent drain 24 and plumbing unit 26 than is possible using conical drain adaptor 36 of the first embodiment.

The size and shape of actuator handle 64 offers certain advantages over the simpler actuator handle 40 of the first embodiment. For one, it provides a larger and potentially more ergonomic gripping zone, while still providing a similar grip end that is similar to that associated with actuator handle 40, in the instance that a user may be more comfortable with that style of a grip. Additionally, the handle bar style grip with the wide ends helps to ensure that the handle will be held outside of second vessel end 46 and stopped from entry into vessel interior 42 due to the interaction of handle 64 with second end stop 50.

Figs. 9 and 10 generally illustrate the two stages of use for the third embodiment of the present invention, generally labeled as piston plunger 70. Piston plunger 70 includes a vessel member 72 with a vessel handle 74 affixed thereto and an accordion/bellow structure 76. Accordion/bellow structure 76 has first and second structure ends 80 and 82 and an intermediate folding interconnect portion 84 therebetween. First and second structure ends 80, 82 and folding interconnect 84 thereby define a variable interior volume V' 78 within the accordion/bellow structure 76. First structure end 80 has a first end opening 85 associated therewith to allow fluid connection between accordion/bellow structure 76 and an appropriate drain adaptor (not shown). Accordion/bellow structure 76 is an integral structure such that all of the parts associated therewith are integral with one another. Accordion/bellow structure 76 is ideally formed of an elastomeric material or at least a highly elastic polymeric material to thereby accommodate the compression and extension of the folding interconnect 84.

The second structural end of accordion/bellows structure 76 includes portions which serve the same functional purposes as plunger piston 32, piston actuator 34, and actuator handle 40. Specifically, second structure end 82 effectively includes a piston surface 86, a bellows actuator 88, and a bellows handle 90. The inner surface of second structural end 82 can be considered to be a piston surface 86 as it is this surface which is able to act in a similar manner as the fluid side of plunger piston 32 of the other embodiments, in both the suctioning and the expulsion of a fluid relative to interior volume V'.

The accordion/bellow structure 76 of piston plunger 70, as indicated in Figs. 9 and 10, is configured such that the expansion of folding interconnect 84 from its compressed version shown in Fig. 9 to its fully expanded version shown in Fig. 10 allows for a change in volume of approximately 0.56 gallons. This volume change thereby represents the approximate potential intake that can be achieved during expansion of interior volume V'.

It is to be understood that folding interconnect 84 provides for a built-in piston travel stop for the expansion of the accordion/bellow structure. This is true as folding interconnect 84 is integrally attached to each of first and second structure ends 80, 82. Thus, folding interconnect 84 can be considered to be another appropriate travel stop means relative to the second vessel end.

While this invention has been described as having a preferred design, the present invention can be further modified within the spirit and scope of this disclosure. This application is therefore intended to cover any variations, uses, or adaptations of the invention using its general principles. Further, this application is intended to cover such

departures from the present disclosure as come within known or customary practice in the art to which this invention pertains and which fall within the limits of the appended claims.